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DIRECTORATE OF PLANT PROTECTION, QUARANTINE AND STORAGE
MINISTRY OF FOOD AND AGRICULTURE, GOVERNMENT OF INDIA

PLANT PROTECTION BULLETIN

SCIENCE IN PRACTICE

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NOTE

This Bulletin is intended to disseminate information about plant protection measures and campaigns adopted or conducted in different parts of India as well as about the advances made in the field of plant protection in other parts of the world, to the extent possible. It is also intended to give information about the latest developments in the production and use of pesticides, and plant protection equipment as well as about techniques of pest and plant disease control. Elaborate scientific papers on Entomology or Plant Pathology or on the chemistry of pesticides would normally not be in place in this Bulletin but short notes dealing with the behaviour or distribution of pests and plant diseases and brief reports on their epidemiology, control, etc., would be welcome. Plant protection has now become such a specialised science and yet is so diversified and consequential in its character and application that it is difficult to define the scope of the subject with any great precision. The general rule to be observed is that any information which can be useful in preventing or controlling damage to crops, fruit trees, plantations and stored agricultural commodities caused by pests and diseases, should be a fit subject for publication in this Bulletin.

Manuscripts submitted for publication in the Plant Protection Bulletin must be typed in double spacing on one side of the paper only, leaving ample margin on the left, at the bottom and on the top of the page. Photographs or drawings must be accompanied by a clearly typed legend for being reproduced under them. In addition, they should bear, on their reverse, in clear handwriting in pencil, the name or names of the author or authors and the article which they illustrate. Local names of insects, diseases, weeds, crops and plants, if used, must be commenced with a small, not capital letter and under lined and must invariably be followed by their scientific or well known English names. Localities or place names should be clearly indicated by reference to well known districts or States or both.

While this Directorate will take every care to include only such material in the Bulletin as may be considered reasonably correct and useful, it can accept no responsibility for every statement made and every opinion expressed. Due to various unavoidable reasons, the appearance of this Bulletin has been far behind the scheduled time. While this is greatly regretted, every effort would be made to avoid delays in future. Those who may read this Bulletin are invited to offer criticisms and suggestions for its improvement.

K. B. LAL

NEW DELHI

PLANT PROTECTION ADVISER TO THE GOVERNMENT OF INDIA

ALL-INDIA PLANT PROTECTION CONFERENCE, NEW DELHI, 1956

An All-India Plant Protection Conference was convened by the Ministry of Food and Agriculture, Government of India, at New Delhi, from 27th to 30th August, 1956, to discuss the methods, plans and problems of plant protection and to review the progress and developments made in this field since April 1952, when a similar Conference had discussed them. The Conference was inaugurated by Dr. Punjabrao S. Deshmukh, Union Minister for Agriculture, and attended by 37 officers from 21 States as well as by the officers of the Directorate of Plant Protection, Quarantine and Storage and technical representatives from the Community Projects Administration, the Directorate of Agricultural Extension, the Directorate of Storage and Inspection and the Entomology and the Mycology Divisions of the Indian Agricultural Research Institute, New Delhi. The Conference synchronised with the commencement of the Second Five Year Plan period as well as with the Tenth Anniversary of the Directorate of Plant Protection, Quarantine and Storage and was, therefore, appropriately timed for personal discussions and exchange of views among plant protection workers from different parts of the country. On the 28th and the 30th August, 1956, some films relating to plant protection were shown in the afternoon and on the 29th August, a demonstration of some plant protection machines was given. A group photograph of the participants in the Conference was also taken.

In this issue of the Plant Protection Bulletin are reproduced the inaugural address by Dr. Punjabrao S. Deshmukh and the conclusions and recommendations of the Conference on the various items that were discussed by it. The Conference also approved the report of the Director, Locust Control, for 1955-56, from which an extract dealing with the locust situation in India during 1955, appears in this issue.

ALL-INDIA PLANT PROTECTION CONFERENCE, NEW DELHI

27th to 30th August, 1956

INAUGURAL ADDRESS

By

Punjabrao S. Deshmukh,

Minister for Agriculture, Government of India.

It is with great pleasure and satisfaction that I welcome you to this Conference this morning. I am pleased because it is always so good to meet agricultural scientists and workers from our different States. I feel a kind of satisfaction because I see in this Conference a big step forward being taken towards improving the standards of our plant protection work and extending it over much larger areas than has been possible so far. Plant Protection has always appeared to me to be one of the important measures that can be taken to increase yields, improve quality and to conserve properly what has been produced. You, who are closely connected with plant protection, have it in your power to make substantial contributions towards the achievement of our targets of agricultural production.

Last June, at Mussoorie, we met in a Conference of State Ministers of Agriculture and their officers to consider to what extent the targets of agricultural production, specially those of foodgrains, oilseeds, cotton, jute, sugarcane and some other crops, could be increased over the targets of 15 per cent of foodgrains and 22 per cent of cash crops already laid down for achievement by 1960-61. The Conference came to the conclusion that, with additional financial allocations, the target of foodgrains production could be raised from the 10 million tons laid down in the Plan to 16.4 million tons and, of this latter figure, at least one million tons could be the result of plant protection measures. Besides, the effect of plant protection measures was also to be reflected in increasing the production of other agricultural crops. It has, therefore, been my endeavour to take every single factor that may increase agricultural production and to see that the maximum exploitation of every such factor is ensured. However, long before we began thinking of revising our targets of agricultural production under the Second Five Year Plan, I felt the need for intensifying and extending our plant protection work. For, I am quite clear in my view that, whatever targets of production we may or may not fix, we must strive to our utmost to extract every ounce of produce that our land may be capable of yielding and this desired result cannot be achieved without paying proper and adequate attention to plant protection.

As you know, the Central Directorate of Plant Protection, Quarantine and Storage, which is the official host for this Conference, was established in 1946. Since then, practically all of our States have established plant protection organisations of their own and the importance of this aspect of our agricultural activity has been increasingly recognised by Governments, the Planning Commission,

farmers and others. Appropriately, therefore, this Conference is meeting on the Tenth Anniversary of the Directorate. During these last ten years, four Plant Protection Conferences have been convened, the last of which was held in April, 1952. That was near the beginning of the First Five Year Plan period. Much has happened since then. Many improvements in plant protection methods and techniques have been made. Much experience of plant protection work in the field has been acquired and many problems and difficulties have also doubtless been encountered. The rapid increase in the number of Community Projects and National Extension Service Blocks has materially added to the facilities for conducting pest and disease control campaigns in the villages. Above all, the farmers themselves have realised, as never before, the need for protecting their crops against pests and diseases and have begun to demand advice and assistance for doing so. All this and more has been to the good but now we are at the beginning of the Second Five Year Plan period and under the urgent necessity of increasing our agricultural production. Emphasis is being laid on intensive cultivation and, in particular, on increasing the production of fruits and vegetables. Efforts would be continued to put the maximum area possible under the Japanese method of paddy cultivation and to increase the use of manures and fertilisers in various crops. It is obvious, therefore, that plant protection would have a very important role to play in these developments.

I have no doubt that the State Governments are fully aware of these requirements and that you are all busy with your own programmes and problems of plant protection. It was exactly for this reason that we felt that a meeting of those who are engaged in plant protection work, both at the Centre and in the States, should be of great value and help to all concerned, specially at the present time when the various schemes and projects under the Second Five Year Plan are being initiated. This is also the time when you can most profitably discuss the technical and other aspects of plant protection against the background of your experience of the First Five Year Plan. Are most effective and suitable techniques for controlling pests and plant diseases being employed everywhere in our country? Is the cultivator receiving the assistance for plant protection to which he may be justifiably entitled ? Does an adequate machinery exist in all of our States for promptly reporting pest and disease outbreaks and for providing the required assistance for control campaigns? Is there sufficient and effective collaboration among Plant Protection organisations, Community Projects, National Extension Services and such others interested in the protection of crops from pests and diseases? Are publicity and propaganda sufficiently well organised to transmit all relevant information to the farmers in simple form? These are some of the questions to which you would have to address yourselves and I notice from the provisional agenda that they are all down for discussion in one form or another.

In our planning, we have been laying down targets of expected achievements and in doing so we have naturally considered not only the ways and means and resources but also the problems, difficulties and bottlenecks. Your Conference would doubtless have to cover such aspects of plant protection. I realise that pest and disease

attacks are uncertain factors and that the elements of chance and suddenness enter largely in your work. Still, pests and diseases have been with us for a long time and would continue to be so as long as we continue to grow crop. We have, therefore, the experience of when, where and how they appear, and we can draw on this experience to determine the demands for plant protection in the future. We have to measure up this demand in terms of our likely achievements and call that a target. For it is not enough that we prepare to meet all situations but we must also know in advance what and where our efforts are likely to lead to and what would be their impact on the overall situation. I should, therefore, suggest that you may also consider how best you may define the contribution that we all expect plant protection to make towards agricultural production.

In spite of the developments in plant protection that have taken place in our country, the crop areas that have been treated against pests and diseases have been very small fractions of those that have needed treatments. If that be so, no efforts and no provision that we make for plant protection under our present limitations anywhere are too much or too adequate. It is on the realisation of this basic fact that the Central Government decided last year to establish some Plant Protection Centres in different parts of the country under a Central Pool of Plant Protection Equipment. It has been repeatedly made clear that these Centres are not intended to run services parallel to those provided by the State Plant Protection Organisations. They are rather meant to afford additional facilities to the State Governments in fighting pest and disease outbreaks. I trust, therefore, that you would regard these Centres as sources from which you may draw reserves of equipment, pesticides and even personnel in times of emergencies and which may also be utilised to supplement your normal activities of plant protection training, pest and disease surveys, evaluation of operational results and so on. I understand that something like what we are attempting in this country for pest and disease control in general has also been considered on an international basis for locust control by experts meeting under the auspices of the Food and Agriculture Organisation of the United Nations. In all public endeavours, co-operation and collaboration are essential ingredients of success. We desire the closest co-operation and collaboration in plant protection work not only between the Central Government and any one State Government but also among the different States of our country. For this reason, I have been happy to learn that the States of the Punjab, PEPSU, Himachal Pradesh and Kashmir have jointly constituted a Plant Protection Board under which the Plant Protection Officers of these Governments meet and discuss common problems of pest and disease control. This Conference is in a way the projection of the same idea on an all-India basis.

I am sure you agree with me that isolated, sporadic efforts should give way to sustained and co-ordinated endeavours, not that I suggest that we have not been moving in this direction already. Persistence and co-ordination pre-suppose common understanding and a basically standardised pattern of work. It is only in this way that the results of plant protection operations can be compared and

achievements assessed. It is here also that the Directorate of Plant Protection, Quarantine and Storage can help by disseminating useful information and co-ordinating efforts.

We in the Ministry of Food and Agriculture are anxious that every effort must be made everywhere to prevent waste and damage caused through the attacks of pests and diseases. I shall, therefore, await the results of your discussions with great interest. Your conclusions and recommendations would constitute a considered assessment of the problems and requirements of plant protection. They would receive the most careful consideration in this Ministry and I hope your respective Governments also would accord them the same consideration. I am glad to note that your agenda includes items for discussion not only on technical but also on the organisational aspects of plant protection. For, techniques alone, howsoever perfect, cannot take us very far unless they are backed by sound organisation, effective collaboration and adequate resources.

I must thank your Governments for responding to our invitation by deputing you to attend this Conference. You have my best wishes in your present task, which indeed does not end but only begins with the conclusion of this Conference on the basis of greater understanding, greater collaboration and greater hope.

CONCLUSIONS AND RECOMMENDATIONS OF THE ALL-INDIA PLANT PROTECTION CONFERENCE HELD AT NEW DELHI, FROM 27TH TO 30TH AUGUST, 1956.

The conclusions and recommendations are based on the views and decisions of 37 State Entomologists, State Plant Pathologists, State Plant Protection Officers and others after a fairly thorough discussion of the various problems of plant protection involved. The implementation of the recommendations in the various States and by the Central Government would greatly assist in promoting the control of pests and plant diseases and the consequent increase in agricultural production in general and food production in particular.

ALL-INDIA PLANT PROTECTION CONFERENCE

Item No. 1

Plans and Policies for the Second Five Year Plan

Appreciating the need for fixing targets of additional agricultural production to be achieved through plant protection measures, *realising* that such targets cannot be fixed precisely for specific crops or in respect of the control of specific pests and plant diseases but *believing* that some over-all assessment of this kind can be made, the Conference *recommends* that :

(i) All State Plant Protection organisations should forthwith assess the additional production to be achieved per acre on the basis of normal expectations of pest and disease outbreaks and the resources and facilities available to control them, in respect of the following crops :

(a) Cereal and other Food Crops—(Wheat, Barley, Paddy, Millets, Gram and other Pulses)

(b) Cash Crops—(Sugarcane, Cotton, Jute and Oilseeds)

(c) Fruit and Vegetable Crops.

(ii) The assessment should be made for one- and five-year periods ; and

(iii) In assessing likely gains, authentic records and experience gained during the First Five Year Plan period should be relied upon.

Item No. 2

Technical Methods of Pest and Disease Control

Recognising that chemical methods of pest and disease control are not the only methods available and that in many cases mechanical, cultural and biological methods may provide effective and

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stable checks to pest and disease infestations, the Conference *recommends* that :

While pesticides should be used over the largest areas possible in an effort to achieve quick results and to meet the growing day-to-day requirements of plant protection, the possibilities of controlling pests and plant diseases by mechanical, cultural and biological methods should not be over-looked.

Item No. 3

Use of Pesticides in Plant Protection Work

Realising the great importance of the genuineness, good quality and suitability of pesticides for plant protection work, the Conference *recommends* that :

(i) The greatest care should be exercised in selecting suitable pesticidal products and purchasing them preferably from firms which have established their reputation for providing genuine products.

(ii) The Government of India should prepare and circulate annually an approved list of registered dealers in pesticidal products for the guidance of State Plant Protection organisations and others and take steps in laying down standard specifications of these products through the Indian Standards Institution.

(iii) State Governments may take steps to regulate the sale of pesticidal products of approved standards and provide facilities for their sale and distribution to cultivators and others.

(iv) A Pesticides Act should be brought into existence as early as possible to ensure the sale of standard pesticides.

(v) Organisations concerned with plant protection should report to the Directorate of Plant Protection, Quarantine and Storage, New Delhi, cases in which pesticidal products have not been found genuine or up to the mark.

Item No. 4

Problems of Storage

Realising the enormous losses sustained as a result of the damage caused by pests and diseases to various agricultural commodities in storage and *being convinced* of the need for popularising correct practices and measures in relation to the storage of agricultural commodities the Conference *recommends* that :

(i) The problems of storage of various agricultural commodities should be investigated on a sustained basis by some central agency for the benefit of all the States.

(ii) The Community Projects and National Extension Service Blocks should take steps for the introduction of improved types of storage receptacles in the villages made according to the specifications laid down by the Indian Standards Institution.

(iii) The tendency of mixing insecticidal dusts with foodgrains should be discouraged by all State Plant Protection and other organisations so as to avoid risks of contamination of foodgrains with toxic chemicals which may prove injurious to human or cattle health.

Item No. 5

Non-Insect Animal Pests

Appreciating the heavy damage caused to agricultural crops by non-insect animal pests and *realising* that the problems affect practically all the States of India, the Conference *recommends* that :

(i) The Directorate of Plant Protection, Quarantine and Storage should collect, critically examine and disseminate information regarding the methods and measures for controlling non-insect animal pests practised or in vogue in some State or States for the benefit of other States where similar problems exist.

(ii) The Directorate of Plant Protection, Quarantine and Storage should organise campaigns against specific non-insect animal pests on a regional basis in collaboration with the concerned State organisations.

(iii) The technique for the control of flying foxes, evolved by the Directorate of Plant Protection, Quarantine and Storage, after it has been further improved, should be demonstrated and popularised in the areas where flying foxes are a serious menace to the fruit industry.

Item No. 6

Control of Weeds and Angiospermic Parasites

Realising that weeds and angiospermic parasites greatly hamper agricultural production, the Conference *recommends* that :-

(i) Publicity and propaganda, emphasizing the need for controlling weeds and angiospermic parasites by chemical, cultural or mechanical methods should be intensified.

(ii) Weeds and angiospermic parasites capable of wide distribution and infesting large agricultural tracts, should receive special attention and, wherever possible, chemical methods of weed control may be adopted.

(iii) Investigations on the chemical control of weeds should be intensified.

Item No. 7

Application Problems

Realising the need for suitable machines of high performance value, for use in plant protection work, *being aware* that even good machines are some times rendered useless on account of the non-availability of their spare parts at the time of purchase or subsequently, *recognising* that the lowest priced machines are not necessarily the best required for plant protection purposes and *noting*

that up-to-date and critically assessed information about them are not always available to all State Plant Protection organisations, the Conference *recommends* that:

(i) Great care should be exercised in selecting only such plant protection machines as have been tested and found suitable under Indian conditions.

(ii) Steps should be taken to ensure that a reasonably adequate supply of spare parts of all plant protection machines specially those which are power operated and imported, is maintained and is available at the time of purchase or subsequently.

(iii) Insistence should not be laid on purchasing necessarily the lowest priced machines.

(iv) Standard specifications for plant protection machines, at least for major uses, should be laid down by the Indian Standards Institution.

(v) A list of approved firms dealing in them should be prepared annually by the Government of India and circulated to the State Plant Protection organisations and others for their guidance.

(vi) State Plant Protection organisations should report to the Directorate of Plant Protection, Quarantine and Storage, New Delhi, cases in which machines have not been supplied by the firms according to stipulated specifications and obvious expectations and have been found defective in performance tests.

Item No. 8

Use of Aeroplanes in Plant Protection Work

Realising that during pest and disease epidemics, when control measures over vast areas within a short time are required, ground spraying and dusting of crops are often not helpful and *being aware* that aerial methods of pest and disease control have still to be demonstrated and popularised, the Conference *recommends* that:

(i) The Government of India should arrange for aeroplanes and other connected facilities for the spraying or dusting of crops and plantations from the air in different parts of India.

(ii) The charges for operational flying upto a maximum of 10 hours for the first time in any State should be borne in full by the Government of India but the costs of pesticides should be borne by the State Government concerned or the farmers or both.

Item No. 9

Training in Plant Protection.

Recognising that the proper application of pest and plant disease control measures is as important as the correct selection of pesticides and machines, *realising* that proper application cannot be

ensured unless plant protection workers are well trained for operational jobs and *considering* that different grades and types of workers are usually employed in plant protection work, the Conference *recommends* that:

(i) State Plant Protection organisations should organise a regular system of training and refresher courses in plant protection not only for their own staff but also for other extension staff, such as, those of Community Projects, National Extension Service Blocks, etc., required to assist in pest and plant disease control work.

(ii) State Plant Protection organisations should organise mobile training squads, which may go round the countryside periodically and impart training in simple methods of plant protection to the farmers.

(iii) The Directorate of Plant Protection, Quarantine and Storage should organise regional training courses or programmes in plant protection at selected places in India for the benefit of the staff of plant protection and other organisations of the region, in collaboration with the concerned organisations of the region.

(iv) The Directorate of Plant Protection, Quarantine and Storage should prepare a basic syllabus for such training at two levels, which, with such modifications as local or regional conditions may necessitate, should be followed generally.

Item No. 10

Pest and Disease Surveys

Item No. 11

Assessment of Damage Caused by Pests and Diseases to Crops

Realising the great importance of pest and disease surveys and of the assessment of damage to crops caused by pests and diseases in plant protection work, the Conference *recommends* that:

(i) Pest and disease surveys may be initiated at least in some areas by the Directorate of Plant Protection, Quarantine and Storage in collaboration with the State Plant Protection organisations concerned and that the results of such surveys should be critically examined, collated and circulated for general information.

(ii) Methods for conducting pest and disease surveys as well as for assessing damage caused by pests and diseases to crops should be evolved by research organisations.

(iii) Meanwhile surveys and assessments on the basis of available information should not be delayed but started as soon as possible.

Item No. 12

Publicity and Propaganda

I. *Being informed* that some workers have issued certificates or letters of recommendations about the efficacy of certain pesticides,

etc., to commercial firms and that these firms have used such certificates or recommendations for propaganda and publicity for their own products, thereby embarrassing other workers at times, the Conference *recommends* that :

No certificates or recommendations should be issued to commercial firms or their agents by research or plant protection workers but scientific reports on the performance of pesticides and plant protection machines should be published from time to time in scientific periodicals or the Plant Protection Bulletin of the Directorate of Plant Protection, Quarantine and Storage.

II. *Being informed* that some recommendations for the control of pests and plant diseases, made on all India basis, have at times been incorrect or unhelpful, thereby creating difficulties in plant protection work, the Conference *recommends* that :

Recommendations for the control of pests and plant diseases made on an all India basis and intended for being followed in different parts of the country should not be made without prior consultation with the Directorate of Plant Protection, Quarantine and Storage.

III. *Being convinced* that sufficient publicity was not being given to well tried and approved measures of plant protection and *realising* the need for intensifying publicity and propaganda in relation to plant protection work, the Conference *recommends* that :

(i) The State Plant Protection organisations should intensify efforts for conducting propaganda and publicity regarding suitable methods and measures of plant protection among farmers and fruit growers.

(ii) Mobile units equipped with posters, leaflets, samples of pesticides and plant protection machines and such other materials for publicity and propaganda should frequently go round the country-side and explain to the farmers and fruit growers the required measures and methods of plant protection.

(iii) The Plant Protection Centres of the Directorate of Plant Protection, Quarantine and Storage should assist in disseminating useful information about plant protection methods and measures in collaboration with the State Plant Protection organisations concerned.

Item No. 13

Organisational Set-up of Plant Protection Work in the States

I. *Realising* that plant protection work as an extension activity has expanded greatly, *recognising* that a close collaboration must be maintained between organisations for research in plant pathology and entomology and for plant protection and *considering* that the progress of plant protection work is dependent on sustained researches on pest and disease problems, the Conference *recommends* that :

(i) Research officers for plant pathology and entomology should be relieved, as much as possible, of administrative responsibilities in connection with plant protection work.

(ii) The technical control of plant protection work should vest with the State Entomologist and the State Plant Pathologist.

(iii) The administrative work and execution of plant protection programmes and campaigns should be the responsibility of the State Plant Protection Officer, who should obtain technical advice from research organisations.

(iv) The fullest collaboration should exist between the plant protection organisations and the concerned research organisations.

(v) There should be unified control of the plant protection organisation in a State as a whole.

II. *Recognising* that the same pest sometimes attacks different crops at the same or different times of the year, the pest and disease control operations on one or more crops have at times to be integrated, that the experience gained with pesticides and machines in respect of any one crop may be usefully utilised in respect of another and that it is not desirable to restrict the outlook and experience of plant protection workers to any one crop or even groups of crops, thereby isolating them from the main current of plant protection activities, the Conference *recommends* that :

(i) There should be only one unified plant protection organisation in a State.

(ii) Plant protection organisations should not be set up on the basis of special crops or groups of crops or on the basis of pest control and disease control separately.

Item No. 14

Plant Protection Policy

Recognising the need for providing all possible facilities to farmers and orchardists for pest and plant disease control by way of supplying pesticides and equipment, the Conference *recommends* that :

(i) All State Governments should adopt the policy of providing pesticides and/or plant protection machines to farmers and fruit growers at subsidised or actual cost rates and for this purpose should make the fullest use of the facilities made available by the Central Government under the Grow More Food Rules and the Central Pool of Plant Protection Equipment.

(ii) All State Governments should adopt the policy of lending control equipment to farmers and fruit growers free or at prescribed rates of hire and for this purpose make the fullest use of the facilities made available by the Central Government under their Central Pool of Plant Protection Equipment.

Item No. 15

Plant Quarantine

I. *Recognising* the danger to crops and plantations inherent in the movement of plants and plant materials from one part of India to another, the Conference *recommends* that :

All State Governments should carefully examine the pest and plant disease situation in their respective territories and take adequate and suitable steps for enforcing necessary domestic quarantine measures under the Destructive Insects and Pests Act of India, 1914.

II. *Realising* that phyto-sanitary certificates issued by State Entomologists, State Plant Pathologists, etc., in respect of plants and plant materials, intended for export, cannot be reasonably expected to guarantee the freedom of the plants and plant materials from pests and diseases till they have actually left the air-port or sea-port of export and *appreciating* the utmost desirability of ensuring that plants and plant materials exported out of India leave the country in sound condition and in accordance with the official phyto-sanitary certificates which accompany them, the Conference *recommends* that :

All plants and plant materials, in respect of which phyto-sanitary certificates have been issued by State Government officers, should be re-inspected and re-treated, if necessary, by the Directorate of Plant Protection, Quarantine and Storage at sea-ports and air-ports from which they may have to be exported. For this purpose, it should be necessary to canalise such exports through such sea-ports and air-ports as have facilities for plant quarantine work provided by the Government of India.

Item No. 16

Assistance by the Directorate of Plant Protection, Quarantine and Storage for Plant Protection Work in India

The Conference considered that the various types of assistance which the Directorate of Plant Protection, Quarantine and Storage should provide, having already been indicated under the various other items of the Agenda, no specific recommendations under this item were required.

Item No. 17

Consideration of the Report of Director, Locust Control, for 1955 and of the continuance of the Co-ordinated Anti-locust Scheme till 28th February, 1957.

Item No. 18

Locust Control and Organisation in the States

Recognising that there is a seasonal inter-change of the desert locust population between the winter-spring breeding areas and the monsoon breeding areas even during the recessive periods between two plagues, *noting* that the individual locusts concentrate in pockets, which are ecologically favourable, leading to the gregarization of the resultant generation and formation of incipient swarms,

realising that if this infestation is not controlled timely at its initial stage, the desert area of India can initiate a fresh locust plague and *noting* further that the gregarization of the migratory locust has also occurred in the desert areas of India this year, the Conference *recommends* that :

(i) During the intervals between two locust cycles, constant watch over the population and behaviour of locusts should be kept and adequate arrangements made for timely control in areas where gregarization may occur. For this purpose, the Government of India should maintain even during such periods an adequate anti-locust organisation on permanent basis.

(ii) States, in which the Scheduled Desert Areas are situated or which adjoin such areas, should maintain adequate staff to continually look out for infestations by the desert and the migratory locusts and adopt control measures as and when required.

(iii) The proposals of the Director, Locust Control, for the continuance of the Locust Warning and Co-ordinated Anti-locust Schemes during 1956-57, as contained in his annual report for 1955 and proposals for 1956-57 and amendments necessitated due to the changes in the locust situation be accepted.

IMPORTANCE AND ECONOMICS OF PLANT PROTECTION IN AGRICULTURAL PLANNING*

By

K. B. Lal,

Plant Protection Adviser to the Government of India, New Delhi.

In the First Five Year Plan, the major emphasis was on the production of food and the agricultural planning was designed to increase the output of cereal crops by extending and intensifying cultivation. In the Second Five Year Plan, although the major emphasis has shifted to heavy industries, the production of food is still being accorded the highest importance and the aim is to promote intensive cultivation and to increase the production of not merely cereals but also of various types of protective foods.

Out of the total provision of Rs. 350 crores for agriculture in the Second Plan, Rs. 167 crores have been reserved for animal husbandry and dairying, forestry and soil conservation, co-operation and fisheries, leaving Rs. 183 crores for various projects concerned with cultivation, in most of which plant protection would be directly or indirectly involved and for which a provision of Rs. 3.05 crores has been made. This figure does not include the amounts provided for specific schemes for the control of weeds, rats, jackals, etc., which are also plant protection measures. It appears, therefore, that about 2 per cent of Rs. 183 crores, provided for various schemes concerned with the development of agriculture proper, would be spent on plant protection.

At the beginning of the First Plan, it was estimated that the annual loss to crops in the field and to agricultural commodities during storage, caused by pests and diseases in India, was of the value of Rs. 600 crores. Foodgrains alone were considered to be destroyed annually in storage through pests, etc., to the extent of 2.5 million tons, a quantity sufficient to provide food to over 1½ crores of people for a whole year. Another estimate put down our annual crop losses through pest and disease attacks at about 20 per cent of the total yield. Apart from these and other estimates available for specific crops in specific regions or in respect of specific pests or diseases, it is now well known that insects, eelworms, crabs, snails, slugs, mites, rodents, jackals, monkeys, flying foxes, virus, bacterial and fungal diseases, weeds, parasitic plants and many other such agencies are responsible for substantial reductions in crop yields and deterioration of crop produce in storage. Indeed, pests and diseases constitute almost the limiting factor in the production of many crops in many areas, for example, San Jose scale of apple in Jammu and Kashmir and Himachal Pradesh, top borer of sugarcane in the Punjab, *gundhy* bug of paddy in Uttar Pradesh, late blight of potato

* Summary of talk given to some Development Officers under Training at the Development Officers' Training Centre, Nilokheri, Punjab, under the Community Projects Administration, on the 14th May, 1956.

in West Bengal, castor semi-looper in Hyderabad, coconut diseases in Travancore-Cochin, not to speak of locusts, field rats and seed-borne diseases which affect many crops over vast areas.

Crop pests and diseases have been with us ever since cultivation began and would be as long as we continue to raise crops. Good seed, adequate and timely irrigation, judicious use of manures and fertilisers, green manuring, deep or shallow ploughing, clean cultivation, etc., etc., do not necessarily eliminate or even reduce pests and diseases attacks. In fact many pests and diseases, which were not known or destructive before, appear with the introduction of new and improved varieties and new and improved methods of cultivation. Improvements in agriculture necessitate greater attention to plant protection.

It is obvious, therefore, that any planning for increasing crop production must take into account the inevitable need to protect the crop and its produce in storage from pests and diseases. This is specially so when it is intended to increase production not so much by increasing the area of cultivation as by trying to take the maximum yield out of a unit of area. Here it becomes important to avoid damage and waste and this measure by itself steps up production. Secondly, if the object is to increase production not only of cereals but of all protective foods, the need for plant protection again becomes paramount. Protective foods that can be grown are fruits and vegetables and perhaps sugarcane and it is these crops that are attacked by a large variety of pests and diseases in all stages of their growth. Plant protection, therefore, assumes much greater importance in the Second Five Year Plan than it had in the First.

Plant protection measures may include the following :—

(i) Mechanical removal of pests, including weeds, and disease-affected plants.

(ii) Mechanical devices to protect crops and crop produce from pest attacks.

(iii) Adoption of cultural practices and use of resistant varieties to minimise pest and disease attacks.

(iv) Liberation of natural enemies of pests in areas of infestations by them with a view to controlling pests.

(v) Direct destruction or warding off pests and disease organisms by the use of chemical and other poisons.

(vi) Prevention of the entry and spread of foreign pests and diseases into India, liable to be received through imported plant materials.

(vii) Legislative and executive steps to ensure co-ordination of action and timely adoption of control measures over a wide area.

Linked with the above-mentioned measures are such ancillary requirements as surveys of pest and disease incidences, forecasting of pest and disease outbreaks, training of operational personnel, publicity and propaganda.

Plant protection measures must not only be effective but also economically remunerative as well as free from undesirable consequences to crops, soils, operators, domestic animals and useful insects. It is difficult to say what fraction of the cost of cultivation of a crop should be spent on plant protection measures. These measures can be preventive or curative or both combined. The cost of a preventive plant protection measure would obviously be determined by the value of the crop and its liability to pest and disease attacks. The cost of a curative treatment would depend on the value of the crop yield that would be lost or deteriorated in quality if the measure is not adopted. The economics of plant protection, therefore, has inevitably to be related to the economics of crop production or produce conservation. While an investment may be sound if it brings a return of any thing more than its initial value within a reasonable period, an investment for plant protection should generally not be considered sound if it fails to give a return at least ten times its value. This of course does not cover the cases of experimental or specially valuable crops that must be protected at any cost.

The various campaigns against pests and diseases carried out in different parts of India during the past 8 or 9 years provide interesting information on the economics of plant protection measures. On the basis of a campaign conducted against field rats in Hyderabad State in 1955 over 10,000 acres, it was estimated that a gain of 300 tons of foodgrains, costing about Rs. 90,000 was achieved. The expenditure on the campaign was Rs. 4,500, which was spent mostly on poison baits. Spraying against the late blight disease of potato crop in Meerut district of Uttar Pradesh in 1949-50 at a cost of Rs. 7-4 per acre was said to have given an additional yield of 29½ maunds per acre, costing Rs. 236. Spraying against mango hoppers at a cost of about Re. 0-12-0 per tree saves crop worth Rs. 5 to Rs. 10 per tree. Spraying of castor plantations against the semi-looper pest in Hyderabad State at a cost of about Rs. 10 per acre is expected to save crop worth Rs. 60 per acre. Pre-sowing treatment of cereal seeds against seed-borne diseases at a cost of about six annas per maund is expected to add about a maund to the yield per acre by improving germination, even if no disease normally appears. Aerial spraying of sugarcane crop against the Pyrilla pest in Bhopal in 1954 at a total cost of about Rs. 11 per acre saved 600 acres of the crop from practically complete destruction. Even if the yield of sugarcane per acre may be taken to be only 200 maunds, it appears that an expenditure of Rs. 11 brought in a return of Rs. 300, that is, nearly 28 times. Some vegetable growers in the Punjab are getting a return of Rs. 1,500 per acre by using sewage water and giving two or three sprayings of DDT or BHC. Without the sprayings, they say, even half the crop would not be available. It appears, therefore, that a total expenditure of about Rs. 30 or so brings in a return of about 25 times. It has been our estimate that for every rupee worth of pesticides used, there is a corresponding gain of about Rs. 20 worth of crop. This estimate, checked against some of the preceding and other figures, has not been found to be too wide of the mark.

According to a rough assessment, the total crop area that received various treatments against pests and diseases was over 2.5 million acres in 1951, 4.7 in 1952, 6.6 in 1953, 9.3 in 1954 and probably 10 in

1955 for which full figures are not yet available. These figures do not include extensive areas under such plantation crops as tea, coffee and rubber over which also plant protection measures have been adopted. However, even the increased area of 12 or 13 million acres is a very small fraction of about 350 million acres under cultivation in India. Even if only half of our total cultivated area needs protection from pests and diseases, it would appear that so far only less than one-fourteenth or about 7 per cent of this area has been covered by plant protection measures. The need for intensifying our efforts for plant protection is, therefore, obvious.

However, there has been growing recognition of this need ever since the Bengal famine of 1943 and the acute food shortage following in the wake of the last World War. The recognition led to the establishment of the Central Directorate of Plant Protection, Quarantine and Storage in 1946, which was followed by the establishment of plant protection services in the States. By the end of 1955-56, all the States of India, except five, had set up plant protection organisations. During the period of the First Five Year Plan, about a thousand technically trained personnel was employed by the Central and State governments, apart from the large body of extension workers who also assisted in the campaigns against pests and diseases. Spraying, dusting and other plant protection machines were increasingly brought into use and their total number with Government departments rose from a few thousands in 1951-52 to about 32,000 in 1955-56. The value of pesticides used likewise increased from about Rs. 10 lakhs in 1948-49 to over a crore of rupees in 1955-56.

The total provision in the First Five Year Plan was of Rs. 350 lakhs for plant protection schemes in the States and of Rs. 60 lakhs for the Central Directorate of Plant Protection, Quarantine and Storage. During the Second Five Year Plan, the total new expenditure on plant protection schemes is to be Rs. 266 lakhs in the States and Rs. 39.2 lakhs in the Central Directorate of Plant Protection. There would, in addition, be the older expenditure on facilities already created for plant protection work during the First Plan or earlier. It is expected that as a result of these provisions the volume of plant protection work in the country would be almost doubled.

SOME INSECTS OF ECONOMIC IMPORTANCE IN KULU VALLEY, PUNJAB

By

H. N. Batra,*

Technical Officer,

Directorate of Plant Protection, Quarantine & Storage, New Delhi.

The author had an occasion to visit Kulu Valley in connection with the control of aphids at the Central Vegetable Breeding Station, Naggar, Kulu Valley, in October, 1951 and April, 1952. This opportunity was also availed of, in collecting some insects of economic importance in the valley, an account of which follows. It will be observed that several pests were recorded for the first time in Kulu Valley and several new hosts for the pests already known were met with. The regional distribution of the pests at various altitudes, *e.g.,* Palampur (4,072 ft.), Kulu (3,994 ft.), Katrain (Baragraon, 5,100 ft.), Naggar (5,600 ft.) and Manali (7,500 ft.) and the degree of the damage they cause are also of interest.

COLEOPTERA

Chrysomelidae

Aulacophora foveicollis (Lucas).—The red pumpkin beetle was recorded at Naggar (5,600 ft.) as a minor pest, but it was observed as a major pest of cucurbits at Palampur.

Diorhabda lusca Wlk.—This pest was seen damaging celtis trees at Palampur. It was gathered that a few trees in a localised area were attacked by the pest every year. The damage was, however, not wide-spread. The grubs were observed hibernating in the cracks or crevices in the trunk or in the soil below the tree.

Pachnephorus impressus Rosenb.—The flea beetle, *Pachnephorus impressus* has a wide distribution. In India it has been recorded from Pusa, Kalyan, Hyderabad and Coimbatore. Outside India, it is known from Peshawar (West Pakistan), Burma, Europe, Africa, Philippines and Macassar. The known hosts of the pest are sugarcane, maize, lady's finger and *til* (*Sesamum indicum*). Fletcher (1921) mentioned it as a pest of *til* at Hoshangabad. The flea beetles were found damaging cherry leaves fairly commonly at Naggar and Manali. The leaves were found riddled in April and May. This pest of cherry in Kulu Valley has not been recorded earlier.

Asamangulia cuspidata Mlk.—The sugarcane hispa, *Asamangulia cuspidata* is known to damage the leaves of sugarcane, *Saccharum spontaneum,* jowar, oats and rice. Stray specimens of the beetle were collected on cherry, apple and persimmon at Palampur, Naggar and Manali. The damage was not apparent but the indications were that the beetles could subsist on the leaves of fruit trees in the absence of their normal hosts. It will be interesting to find out the normal hosts at such elevations, where cane is not grown.

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* Now in the Division of Entomology, Indian Agricultural Research Institute, New Delhi.

Scelodonta strigicollis Motsch.—The occurrence of the grape flea beetle was noted for the first time in the valley. It was collected on the foliage of rose at Kulu, cherry at Naggar and persimmon and peach at Manali in April-May. It is a severe pest of grape vines in other parts of India and may damage the vines in this valley as well.

Haltica caerulescens Baly.—This blue beetle was very common throughout the valley, feeding on some weeds and roses in April-May. The pest was also present on turnip flowers, cabbage, apple and persimmon at Naggar and Manali, and reported to be a severe pest of cherry foliage at Chail in July.

Phyllotreta sp.—This minute, bluish beetle was observed to riddle the leaves of radish at Sarsai (Naggar) in October.

Mimastra cyanura Hope.—Very common and well known, this beetle defoliates a variety of fruit trees, *viz.*, peach, plum, pear, etc., and other wild-growing plants. It was observed flying about in numbers all along the route from Nagrota (Punjab) to Mandi (Himachal Pradesh) in May.

Cassida icterica Boh.—Some specimens were feeding on plum and beet foliage at Naggar, citrus foliage at Katrain and Baijnath, and pear foliage at Katrain. These beetles resemble Coccinellids in shape as well as in the nature of the damage they cause. The damage, shown by the presence of linear scars on the foliage, was severe on pear leaves .

Curculionidae

Apion sp.—*Apion* beetles were seen damaging the leaves of apple at Naggar and those of walnut at Manali. The damage was fairly heavy, this being the first record of *Apion* sp. occurring as a pest of fruit trees in India.

Tanymechus versicolor Mshl.—A slightly dark brown weevil, *Tanymechus versicolor* was feeding on apple leaves at Naggar in May. It may be added that the species was also collected at Delhi as a pest of pear, *jowar* and maize in the month of July. It had not been recorded earlier in Kulu and Delhi though it was reported from Jorhat, Gauhati and Khasi Hills (Assam), Pusa (Bihar), Allahabad (Uttar Pradesh), Dacca and Sikkim.

Alcidodes porrectirostris Mshl.—The walnut weevil was responsible for heavy damage of walnut fruit in the valley. At Katrain as many as 370 fallen fruits were counted under a medium sized walnut tree and each fruit contained inside 1 to 3 grubs feeding on the kernel. This was another very serious pest of fruits in the valley, which called for early control measures because at some places more than 75% of the walnut fruits were damaged.

Coccinellidae

Adonia variegata Goeze, sub sp. *orientalis* Ws.—Besides the common predators of aphids, *viz., Coccinella septumpunctata* Muls. and *Chilomenes sexmaculata* Muls., *Adonia variegata* G. sub sp. *orientalis* Ws. was the common species feeding on the cabbage aphis, *Brevicoryne brassicae* Linn.

Chilocorus bijugus Muls.—The adult beetles were collected in Manali, feeding on San Jose scale especially on peach trees. It was also a well-known predator of woolly aphis in the valley.

Coleophora sauzeti Muls.—The adult beetles were feeding on apple aphis, *Dorsalis pomi* De G. at Kulu in May. It was already known to feed on woolly aphis in Kulu Valley.

HOMOPTERA

Aphidae

By far the most important and widely distributed aphis pest in the entire valley was the peach curl aphid, *Brachycaudus* (*Anuraphis*) *helichrysi* (Kalt.) causing serious curling of leaves and fall of fruit in April. The nursery plants of almond, peach and apricot were found greatly arrested in growth due to infestation by this aphid at the Horticultural Research Station, Kulu. For the successful cultivation of peach in the valley, the control of the peach curl aphid should receive high priority. A minor infestation by *Dorsalis pomi* on the tender shoots of young plants of apple at Kulu and by *Chromaphis juglandicola* Kalt. on walnut at Palampur was also observed in May. *Lachnus pyri* Buck. was also reported to infest pear trees at Palampur.

Brassica vegetables were infested by the following three species of aphids, mentioned in order of severity, *viz.*, (i) cabbage aphis (*Brevicoryne brassicae* L.), (ii) mustard aphis (*Lipaphis erysimi* Kalt.) (*Rhopalosiphum pseudobrassicae* Davis) and green aphis (*Myzus persicae* Sulz.).

B. brassicae occurred both in the plains and in the hills and was generally a severe pest of cabbage, cauliflower, knol kohl, turnip and radish. In the hills, it was endemic at higher elevations (about 6,000 ft.), where it usually appeared in August and continued throughout winter. The activity of the pest was at its peak in spring, when it became a problem to control it. The greatest disadvantage of the pest was that it greatly limited the production of quality cabbage seed which could not be produced at lower altitudes. Malathion at a strength of 0.04% was tried with very good results in controlling this pest.

Next in importance was the mustard aphis, followed by the green aphis. At Naggar they were usually associated together, the former infesting turnip and radish and the latter infesting turnip, radish and beet root. Their incidence was high in October and November. It was the turnip crop which was liable to heavy damage, both by the cabbage aphis and the mustard aphis. As a result of their injury, the plants were greatly malformed as if attacked by a virus disease. It was possible that apart from the devitalization caused by them, the aphids also acted as vectors of some viruses.

Jassidae

Tettigoniella indistincta Walk.—A solitary specimen of *Tettigoniella indistincta* was collected on cherry foliage at Naggar. It hardly existed as a pest. Distant (1907) described it from a specimen collected at Sylhet.

Coccidae

Eulecanium coryli Linn.—The occurrence of the scale insect, *Eulecanium coryli* as a pest of fruit trees in Kulu Valley was observed for the first time. It was commonly observed on peach, plum, apple and cherry in Kulu, Naggar and Manali, infesting only plum trees heavily.

HEMIPTERA

Pentatomidae

Bagrada cruciferarum Kirk., *Eurydema pulchrum* Westw. and and *E. lituriferum* Wlk. were found as fairly common pests of cruciferous crops at Palampur. *E. pulchrum* was also collected on cabbage from Baragraon.

Halys dentatus Fabr.—So far, the bug had only been recorded from Dehra Dun. It was collected in April on plum at Manali and on apple at Naggar, in the nymphal stages. The bug also occurred commonly on the bark of apple, *jamun* and guava in Delhi.

Lygaeidae

Lygaeus sp. bugs were collected on peach foliage at Palampur. Whether the bugs injured the peach fruits could not be ascertained.

LEPIDOPTERA

Pieridae

Pieris brassicae (Linn.).—The cabbage butterfly was found to be a severe pest of turnip, cabbage and knol kohl at the Central Vegetable Breeding Station, Naggar. The peak period of damage was between mid-April to mid-May, when infestation was so heavy that it was impossible to check the pest by hand collection of its egg-masses and caterpillars. The pest was easily controlled by spraying the infested crops with DDT 0.12%. Within about half an hour of spraying, the caterpillars were observed to be restless, paralysed and unable to feed any longer.

Noctuidae

Prodenia litura (F.) and *Laphygma exigua* (Hb.) were fairly severe pests of cabbage in October at Naggar. In severe infestations the leaves were found skeletonized. The latter species also occurred as a pest of potato at Palampur in May.

Plusia orichalcea Fab.—The caterpillars were found damaging lettuce and carrots at Naggar. Eggs were also laid on a weed, *Conyza ambigua* and the caterpillars fed on the leaves of *Conyza ambigua*, Cosmos (flower plant) and *Polygonum* sp.

Leucania (*Cirphis*) sp.—It was a pest of wheat in Katrain. In May 1953, the population of the pest was heavy on wheat crop, each plant having 1 to 3 caterpillars on it. As soon as the wheat ripened, the caterpillars migrated to vegetable crops and damaged lettuce, growing in the vicinity of wheat.

Agrotis sp.—The cutworms were highly destructive to lady's finger at Palampur and to other vegetables at Naggar in May. The

study of the relative incidence of the various species at different altitudes would yield interesting and useful results.

Hymenia recurvalis (*fascialis*) (F.).—Light green larvae of the pest were observed damaging the leaves of beet root at Naggar in October.

Plutellidae

Plutella maculipennis (Curt.).—The diamond-back moth was a common pest of cabbage at Naggar during winter.

Gracillariidae

Gracillaria zachrysa Meyr.—The apple leaf miner and roller was observed, feeding on the tender leaves of apple, for the first time at Kulu in April-May.

HYMENOPTERA

Tenthredinidae

Athalia proxima (Klug.).—The larvae of the mustard sawfly were found damaging turnip and radish at Naggar in October. The latter host was noted to be more susceptible to injury.

Braconidae and Chalcidae

Adult parasites of some Braconids and Chalcids were bred from *Brevicoryne brassicae*. The extent of parasitisation was under 5% in April at Naggar and Baragraon. The other hymenopterous insects collected on the flowers of turnip were, *Apis indica* and *Halticus* sp. (Apidae), *Bombus* sp. (Bombiidae) and *Campsomeris prismatica* (Sauss) (Scoliidae). The above insects played an important role in the pollination of flowers and, therefore, should not be harmed while applying insecticides for the control of the cabbage butterfly and cabbage aphis in April-May. Naggar is at a distance of about 2 miles from Katrain, a famous honey-producing area of the Punjab, and therefore, any indiscriminate use of the new, synthetic insecticides for the control of vegetable pests may affect not only honey production but also the pollination of several important crops in the locality.

DIPTERA

Cecidomyiidae

Anjeerodiplosis peshawarensis Mani.—The damage caused by the fig midge to figs (*Ficus carica*) growing wild along the sides of water channels was observed for the first time at Palampur in May. The damage by this pest appeared to be wide-spread. Batra (1952) recorded it earlier at Delhi.

Agromyzidae

Agromyzid larvae were observed feeding on cabbage aphis at Naggar in April-May.

Syrphidae

Syrphus balteatus De Geer was reared on cabbage aphis and *Eristalis tenax* L. was collected on cabbage plants at Baragraon.

THYSANOPTERA

Thripidae

Pea thrips (unidentified).—An orange coloured thrips was observed to infest pea crop heavily at Naggar in May. As a result of injury the foliage and pods of pea turned grey, losing thereby their shiny green colour. The surface of the pods was greatly mottled. The thrips was also found on cabbage flowers.

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LOCUST SITUATION AND CONTROL IN INDIA DURING 1955*

Pruthi (1950) and Lal (1954) gave detailed accounts of the locust situation in India during the first five years of the desert locust active cycle of 1950-1955. The locust situation in India in 1955 is described here.

Winter-spring

(*i*) *Swarm Movements.*—Between 8th November and 1st December, 1954, 15 swarms entered Rajasthan, across the Indo-Pakistan border. They spread into the interior and during the second fortnight of December, locust activity was reported mainly from Rajasthan, though a few movements were also observed in the Punjab, Uttar Pradesh, Bombay and Saurashtra. In January 1955, obviously due to low temperature and some swarms having flown back to Pakistan, only a few swarm movements were recorded in the last three States. In the second fortnight of February, mature ovipositing swarms were observed in the Punjab and PEPSU, and a pink swarm, which was destroyed, in Saurashtra. The last swarm of the winter-spring period was observed on 3rd March, laying eggs in Chamb Niabat of Jammu and Kashmir State.

The population of overwintering individual locusts in the Scheduled Desert Area was low from January to April, being nil between 25th March and 27th April.

(*ii*) *Breeding.*—The overwintered swarms laid eggs in Ludhiana and Ferozepur districts of the Punjab and Sangrur district of PEPSU during the second fortnight of February and in Chamb Niabat of Jammu and Kashmir State on 3rd March. Breeding was on a small scale and the resultant hoppers were destroyed in their initial stages.

(*iii*) *Control.*—During January-February 1955, parts of 6 pink swarms were destroyed in Jaisalmer district of Rajasthan, killing in all about 500 maunds of locusts.

At the request of the Director of Agriculture, Saurashtra, the staff of the Central anti-locust organisation carried out control operations against settled swarms during January-February, clearing 8 sq. miles of infested area. For these operations, the Central anti-locust organisation also provided 240 lbs. of 40% Aldrin, 2 Power dusters, 1 Power sprayer and 2 vehicles.

An area of 1,884 acres was cleared of hoppers in Ludhiana and Ferozepur districts of the Punjab and 755 acres in Sangrur district of PEPSU, during February-March. A swarm was also partially destroyed in the Punjab.

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* Extract from the Report of the Director, Locust Control, New Delhi, for 1955-56.

Lal, K. B. (1954), *J. Sci & Indust. Res.*, 13A : 560-567.

Pruthi H. S. (1950), *ibid.* 9A : 358-363.

Summer and Monsoon

(*i*) *Swarm Movements.*—The population of individual locusts began to rise from 28th April. This was obviously due to the incursion of individual locusts from the west. The first exotic swarm across the Indo-Pakistan border entered India in Barmer district (Rajasthan) on 9th May. This was followed by more swarms and upto the end of June, 16 swarms, (11 in May and 5 in June) crossed into India. Of these, 3 were pink, 3 yellow and 10 mixed. They actively moved into the interior, their movements being reported from various districts of Rajasthan, Saurashtra, Kutch, Uttar Pradesh, Madhya Bharat, Madhya Pradesh, Vindhya Pradesh Bombay, Orissa and Bihar, the easternmost locality reached being Karahgola (25 25'N 87 20'E) in Purnea district of Bihar. In the south-east, the swarms reached as far as Puri (19° 45'N 85° 50'E) in Orissa. The locust activity declined and there was no further incursion after June but movements of swarms, already present in India, were reported from Rajasthan, Delhi and Uttar Pradesh, the last report being on 30th August in Bikaner district. Thereafter, India remained free of swarms.

(*ii*) *Breeding.*—There was no gregarious breeding in any part of India, during monsoon. Small-scale solitary breeding was, however, observed in Bikaner, Churu, Jodhpur, Barmer and Jaisalmer districts of Rajasthan. Due to this breeding the adult locust population increased abruptly, during October, in some areas of Rajasthan, the maximum being 8,400 per sq. mile.

(*iii*) *Control.*—No control operations were necessary.

The following is an area-wise resume of locust activity and control operations :

(a) Scheduled Desert Area

(*i*) *Swarm movements.*—Although monsoon and post-monsoon breeding was very heavy during 1954, control operations against hoppers were successfully concluded by 18th December and no swarm was allowed to develop. However, there was an autumn incursion of pink swarms, from the west, from 8th November to 2nd December, when 15 swarms (14 in November and 1 in December), entered Rajasthan, across the Indo-Pakistan border. The swarms spread into the interior, generally towards east or north-east. Some of them were partially destroyed and others either flew back into Pakistan or crossed into the cultivated areas. The last report of swarm movement was on 9th February, 1955, between Bhojak (26°57'N 72°14'E) and Chandan (26°59'N 71°18'E) in Jaisalmer district. The population of overwintering individual locusts remained low from January to April 1955.

In the summer of 1955, the first exotic pink locust was observed on 28th April in Nokh area (27°34'N 72°15'E). This was followed by further influx of individual locusts, resulting in the rise of their population in several localities. The first exotic swarm, across Indo-Pakistan border, entered India at Syed Meza Ali Shah-ka-tala (25°10'N 70° 55'E) in Barmer district (Rajasthan) on 9th May. This was followed by more swarms and up to end of June, 16 swarms (11 in May and 5 in June) crossed into Jodhpur and Bikaner divisions.

Of these, 3 were pink, 3 yellow and 10 mixed. There was no immigration after June.

The immigrant swarms spread practically over the whole of the Scheduled Desert Area of Rajasthan and Bombay States. Population of individual locusts also increased, becoming countless in several localities. Due to the prevailing drought the swarms crossed over the desert areas, the general direction of flight being easterly and northeasterly. In August, only 5 small sized swarm movements (mostly unauthentic reports) were reported, the last report being on 30th August from Jasuntsar (28° 32'N 73° 57'E) in Lunkaransar tehsil (Bikaner district). Even if the reports of movements in August are taken as correct, hardly two small swarms were actually involved. As nothing was subsequently heard of them, it is presumed that they got dispersed, crossed into cultivated areas or returned to Pakistan.

(*ii*) *Breeding.*—The general rainfall in the desert areas was delayed by one month, as it commenced in the 1st week of August instead of the 1st week of July. When, as a result of rainfall, the soil moisture became suitable for breeding, practically no swarm was left in the desert areas. The gregarious breeding was, therefore, conspicuous by its absence. Solitary breeding, however, occurred in a few localities, in Churu, Bikaner, Jodhpur, Jaisalmer and Barmer districts. This resulted in the development of individual locusts in some areas, during October-December, raising the population up to 8,400 per sq. mile in Nokh (27° 34'N 72° 15'E)—Bajju (27° 56'N 72° 40'E) sector of Jaisalmer-Bikaner districts.

(*iii*) *Control.*—During January-February, 1955, parts of swarms were destroyed in Jaisalmer district, killing about 500 maunds of locusts.

When the swarms visited the desert areas in May-June, the locusts were very active even at night, obviously due to the prevailing high temperature. Therefore, no control operations against them were possible.

(*iv*) *Damage to crops.*—There was no damage to crops by locusts.

(b) Cultivated Areas

(*i*) *Rajasthan.*—Between 16th May and 1st July, swarms visited Udaipur, Bhilwara, Chittorgarh, Dungarpur, Kotah, Jhalawar, Bundi, Bharatpur, Sawai-Madhopur, Tonk and Pali districts. No damage was caused to the crops.

(*ii*) *Bombay*—During January-February, swarms visited Broach, Kaira, Baroda, Ahmadabad, Amrali and Mehsana districts. Between 10th and 21st May, swarms visited Mehsana and Banaskantha districts.

(*iii*) *Kutch.*—A swarmlet was observed between 17th and 21st May. No damage was caused to crops.

(*iv*) *Saurashtra.*—During January-February, two pink swarms roamed about in Zalawad, Madhya Saurashtra, Sorath and Gohilwad districts. They were completely destroyed with the assistance of the Central anti-locust organisation.

Between 16th and 20th May, a few pink swarms visited Madhya Saurashtra district. No damage was caused to the crops.

(*v*) *Madhya Bharat.*—Between 22nd May and 27th June, swarm movements were reported from Mandasor, Bhilsa, Rajgarh, Morena, Gird and Bhind districts. Damage to crops was negligible.

(*vi*) *Madhya Pradesh.*—Between 26th May and 16th June, swarm movements were reported from Mandla, Jabalpur, Balaghat, Durg, Raipur, Bilaspur, Rajgarh and Sagar districts. There was no damage to crops.

(*vii*) *Vindhya Pradesh.*—One swarm visited Tikamgarh district on 27th May and another Datia district on 26th June.

(*viii*) *Bihar.*—Between 14th and 26th June, swarm movements were reported from Ranchi, Singhbhum, Bhagalpur and Purnea districts, but there was no damage to crops.

(*ix*) *Orissa.*—Between 2nd and 20th June, swarms visited Boudh-Phulbani, Puri, Dhenkanal, Sambalpur, Sundergarh, Keonjhar, Cuttack and Mayurbhanj districts. Control operations were undertaken on some occasions. There was negligible damage to crops and jungle trees.

(*x*) *Uttar Pradesh.*—During January, swarms were present in Aligarh, Mathura and Etah districts.

Between 24th May and 28th August, swarm movements were reported from Jhansi, Ballia, Azamgarh, Deoria, Jalaun, Mainpuri, Aligarh, Etah, Bareilly, Badaun, Gorakhpur, Agra and Moradabad districts.

Rabi crops over 24 acres were slightly damaged.

(*xi*) *Delhi.*—Only one swarm visited Delhi State on 6th July.

(*xii*) *PEPSU.*—Between 22nd February and 3rd March, swarms visited Sangrur and Patiala districts and laid eggs in 7 villages of the former, over an area of 755 acres. Hoppers, which emerged between 23rd March and 3rd April, were completely destroyed in their initial stages by dusting with BHC and by trenching. There was no damage to crops.

(*xiii*) *Punjab.*—Between 14th and 28th February, swarms visited Ferozepur and Ludhiana districts, laying eggs in 7 villages of the former and 12 of the latter over an area of 1,884 acres. The egg-laying commenced on 20th February and emergence of hoppers on 18th March. The resultant hoppers were completely destroyed in their initial stages by BHC dusting, trenching and burning. Only negligible damage to *sarson* crop was caused by the swarms.

(*xiv*) *Jammu & Kashmir.*—A locust swarm laid eggs in Chamb Niabat on 3rd March. Eggs were destroyed.

(*xv*) *Andhra, Madras, Mysore, Assam, Ajmer, Himachal Pradesh.*—There was no locust activity.

SOME IMPORTANT DISEASES OF ECONOMIC PLANTS—UNKNOWN OR LITTLE KNOWN IN INDIA—TRANSMITTED IN NURSERY STOCK RUBBER

By

S. N. S. Srivastava,

Plant Pathologist, Plant Quarantine & Fumigation Station, Directorate of Plant Protection, Quarantine and Storage, Madras.

1. South American Leaf Disease or Leaf Blight (*Dothidella ulei* P. Henn.

Occurrence .. Bolivia, Brazil, British Guiana, Colombia, Costa Rica, Dutch Guiana (Suriname), Ecuador, El Salvador, French Guiana, Guatemala, Honduras, Mexico, Nicaragua, Panama Canal Zone, Peru, Trinidad, Venezuela.

Losses .. A limiting factor in the production of rubber wherever the disease occurs.

Distinguishing features .. Dull, velvety-looking, olive to greyish-green or yellowish spots, sometimes with a thin black margin, on leaves, twigs, inflorescence and fruits; centres of lesions on leaves occasionally drying up and falling away, leaving a shot-hole; distortion of leaves and petioles; swollen canker-like patches on internodes.

Control .. Use of resistant varieties; dusting and spraying with fungicides at considerable costs—almost impracticable.

The disease may be introduced in India as lesions on budwood, budded stumps, or seedlings intended for propagation, on fragments of diseased tissues entrapped in packing materials, and on botanical specimens of *Hevea* species, or as surface-borne spores on *Hevea* seeds or on any other plants grown in the neighbourhood of diseased plantations. Even detached spores of the fungus remain infective for about a week under tropical conditions. Importation of *Hevea* and any other plants from the infected region, therefore, if at all necessary, should only be allowed under permit from the Government of India, and be restricted to very small quantities for scientific purposes. The plant materials should be suitably disinfected in the country of origin prior to export. Propagation material of *Hevea*, especially, should again be examined, disinfected and grown for a suitable period at an intermediate Plant Quarantine Station, outside the American tropics in the western hemisphere, *e.g.*, at Miami, Beltsville or Kew, and repacked in new containers before being brought to India. At the port of entry in our country, the imports

should be very carefully examined and any apparently diseased material immediately destroyed. The rest should be properly disinfected again. It may be thoroughly sprayed with, or dipped in, a 0.15% aqueous solution of Dithane Z-72 (with rosin emulsion added to the solution, 1 : 400), or a 0.2% solution of an 'insoluble copper' fungicide (such as basic copper sulphate), or a 0.6% solution of wettable sulphur in water. Budwood may also, alternatively, be dipped in a 0.2% solution of mercuric chloride in 50% methyl alcohol. After disinfection, *Hevea* planting material should be grown in quarantine for at least 2 months, or for any other desirable period depending upon its growth, to ensure freedom from any infection whatsoever. Seeds should be disinfected by spraying them lightly with a 1:1 formalin solution in water, and keeping them covered for about 4 hours followed by thorough aeration. Packing material must be destroyed. Botanical specimens should be poisoned with 1:1000 aqueous mercuric chloride solution, or preserved in 5% formalin before despatch from the country of origin, or immediately on arrival at a port in India.

The disease has been commonly reported to affect three species of *Hevea, H. brasiliensis, H. guianensis* and *H. confusa. H. pauciflora, H. rigidifolia, H. microphylla, H. nitida* and *H. minor* are 'believed to have a high degree of resistance'.

2. Mouldy rot (*Ceratocystis fimbriata* Ellis and Halst.)

Occurrence	..	Belgian Congo, Brazil, Indonesia, Malaya, Mexico, New Guinea, Papua. Also since reported in India.
Losses	..	Most serious disease of the tapping panel in Malaya; reduces yields considerably wherever it occurs.
Distinguishing features	..	Depressed lesions, sometimes coalescing together, near the cut ends of the budwood or cuttings, or in the region of any other wounds on the bark; tissues dark and covered with a thick greyish mould, rotting away in about a month's time exposing discoloured wood.
Control	..	Rather difficult—no eradication possible.

This disease may be introduced on any plant material obtained from an affected locality, either on infected planting material or on fragments of diseased tissues entrapped in packing material, or as detached spores on the surface of such articles. Even labourers from India, returning home from any affected plantation, may bring in the disease on their clothes and implements. The fungal mycelium and its various spore forms remain viable under ordinary conditions for a long period—3 months or even more. Any diseased budwood or cuttings of rubber, intercepted at the time of import, should be immediately destroyed. The remaining stock may be dipped in Dithane-D 14 (2% solution in water), or 1% solution of Santobrite, and grown in quarantine for a month to detect the presence of any latent infection, before release. Planting materials of any other host, believed to be grown in the vicinity of a diseased rubber plantation

should also be similarly treated. Seeds should be suitably disinfected. Packing material should be sterilised with steam at 20 lbs. pressure per square inch for 10 minutes.

3. White root disease [*Fomes lignosus* (Klotzseh) Bres.]

Occurrence .. Argentina, Belgian Congo, Brazil, British Guiana, Burma, Ceylon, Costa Rica, Fernando Po Islands, French Equatorial Africa, Gold Coast, Indo-China, Indonesia, Ivory Coast, Kenya, Liberia, Malaya, Mexico, New Guinea, Nigeria, Philippines, Sierra Leone, Uganda. Also reported from India.

Losses .. Considerable in nurseries; often 35-50% in older plantations, sometimes causing complete destruction.

Distinguishing features .. Stout, ¼ in. thick, smooth rhizomorphs, usually white in colour, on the roots of stumps and seedlings; occasionally thin hyphae in the grooves at the base of stems.

Control .. Very difficult and costly—examination of individual roots of affected plants, tracing the source of infection and disinfecting the entire root system.

The disease may be introduced on stumps or nursery plants, on pieces of timber or affected roots, or as bits of rhizomorphs in soil and other packing materials from affected localities. The rhizomorphs are very resistant under ordinary conditions. The fungus on bits of diseased roots, buried in soil, has been reported to be infective even after 2 years. The roots of imported plants should be subjected to a very careful examination, and any superficial rhizomorphs noticed should be scraped with a sharp instrument. Those roots which exhibit a deeper infection, *viz.*, discolouration of wood, should be excised and the wound painted with tar. Finally, the basal portions of the plants may be given a dip in 2% copper sulphate solution in water, and the affected roots rubbed gently with the fingers to remove any trace of infection. Packing material should be destroyed. Soil should be sterilised with steam at 20 lbs. pressure per square inch for 2 to 3 hours.

Some of the other hosts infected by the fungus include *Theobroma cacao, Coffea* spp., *Artocarpus integrifolia, Cocos nucifera, Desmodium gyrans, Leucaena glauca, Yucca* sp. and *Erythrina,* and imports thereof should also be carefully checked up and similarly treated, if necessary.

4. Stinking root disease (*Sphaerostilbe repens* B. and Br.)

Occurrence .. Belgian Congo, Burma, Ceylon, French Equatorial Africa, Indonesia, Malaya. Also once reported from Assam (India).

Losses .. Often responsible for complete destruction of plantations.

Distinguishing features .. Reddish-brown, or blackish, flattened, 2-10 mm. broad and 0.5-2 mm. thick rhizomorphs, with a median groove and short, oblique lateral grooves, between the bark and wood of affected roots; edges of rhizomorphs occasionally tinged with pinkish to red fructifications of the fungus wherever exposed; dark lines, marking the situation of the rhizomorphs, on the wood of roots whose bark is decayed.

Control .. Destruction of diseased plantations.

The disease may be introduced on any jungle wood or other plant debris contaminating soil and other packing materials from diseased localities, and rarely on stumps and nursery plants. No definite information is available on the exact period of viability of the fungus, but it is considered that it may remain alive for sufficiently long periods in dead plant tissues, and sporulate profusely under favourable conditions. Rooted plants from infected localities should be very carefully examined, and immediately destroyed if found to be diseased. Any other planting material may be treated as in case of mouldy-rot disease. Packing materials must be destroyed. Soil should be sterilised as indicated for white-root disease.

Artocarpus integrifolia, Maranta arundinacea and *Erythrina* spp. have also been reported to be attacked by this fungus, in addition to some other important host plants such as *Nephelium litchi, Theobroma cacao, Carica papaya, Persea gratissima* and species of *Citrus, Coffea* and *Manihot*. Imports of these plants should also, therefore, be carefully checked.

5. Leaf fall (*Oidium heveae* Steinm.)

Occurrence .. Belgian Congo, Ceylon, Indonesia, Malaya. Also reported from India.

Losses .. Several thousand acres rendered uneconomic in various countries, where yields were reduced by 50–60%, besides ultimate death of trees owing to excessive defoliation.

Distinguishing features .. Curling and/or shrivelling of the young leaves from the tip along the edges, followed by a bluish or purplish-black discolouration; usually isolated, round or irregular spots of olive brown colour and 0.4–1.0 cm. in diameter on badly attacked leaves, sometimes extending on the young twigs.

Control .. Dusting with sulphur at excessive costs and with great difficulty; resistant varieties.

The disease may be introduced on nursery stock, including seedlings and budwood, or on packing materials contaminated with diseased fragments of leaves or inflorescence. Though the conidia of the fungus are very short-lived, the mycelium may remain alive for several weeks and sporulate abundantly. Any plant showing the

disease at the time of import should be destroyed. The rest may be sprayed with a solution of wettable sulphur in water, and grown in quarantine for a fortnight before release. Seeds and packing materials may be treated as indicated above for other diseases.

6. Miscellaneous

In addition to the above, some diseases, noted below, have at times been reported to be of potential danger in certain countries, indicated against them. Some of them could be introduced evidently on living plant materials, imported for propagation, or on packing materials contaminated with fragments of diseased plant tissues. Necessary precautions, as in the case of diseases noted above, may be taken to safeguard against the introduction of these diseases, too, into our country.

(*a*) Target leaf spot [*Pellicularia filamentosa* (Pat. Rogers).]
Bolivia, Brazil, Colombia, Costa Rica, Honduras, Peru, the United States of America.

The disease appears on the leaves as white lesions, about 1 mm. in diameter, with a brown border; these may be coalescing to form blighted areas involving about ½ to 2/3 of the leaf blade.

(*b*) Leaf spot (*Phyllosticta* spp.)

Mexico, French Equatorial Africa, Belgian Congo.

The fungus has been reported to be occasionally severe on nursery plants, causing a lot of defoliation.

A species of *Phyllosticta* has recently been reported to cause a die-back, along with *Gloeosporium* sp., in India.

(*c*) Leaf blight (*Alternaria* sp.)

Mexico.

The fungus was once reported to have caused a very heavy defoliation in young seedlings.

(*d*) Root rot (*Helicobasidium* sp.)

Mexico.

Nursery seedlings were destroyed completely.

(*e*) A disease of obscure etiology, but resembling 'bacteriosis' of *Manihot* sp. (*Xanthomonas manihotis* (Arthaud-Berthet) Starr) has been reported on propagation material in Brazil; while (*Xanthomonas solanacearum* (E. F. Smith) Dowson) has been reported on seedlings from Java.

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USE OF POISON BAIT AGAINST HOPPERS OF THE DESERT LOCUST IN ARABIA

BY

B. D. MANOCHA,

Assistant Locust Entomologist,

AND

S. P. ATRI,

Locust Technical Officer,

Directorate of Plant Protection, Quarantine and Storage.

During February 1954, the Government of India sent a fully equipped mission to Arabia to collaborate in a campaign against the desert locust under the auspices of the Food and Agriculture Organization of the United Nations. The mission adopted two main methods of locust control, *viz.*, poison baiting and poison dusting.

OPERATIONAL AREA

The area allotted to the Indian mission was the southern part of Kuwait and Hassa Province of Saudi Arabia. The approximate length of the area was 350 miles from north to south and the breadth about 150 miles from east to west. Thus the total area to be covered by the mission was about 52,500 sq. miles.

TERRAIN

KUWAIT

The terrain of the Kuwait State is soft, sandy and plain, with gravel and rocky patches here and there, generally in the western parts. There are neither high hills nor high sand dunes.

SAUDI ARABIA

Hassa Province, which was allotted to the Indian mission for operations, can be divided into the following regions as far as its terrain is concerned.

(*i*) *Northern region.*—This region is sandy and mostly flat; but unlike that of Kuwait it has some high hills and sand dunes.

(*ii*) *Eastern and South-Eastern regions.*—These constitute what is called the 'Djufera dune belt' and are almost full of shifting sands and devoid of vegetation.

(*iii*) *Southern region.*—This region covers the Alhassa oases. The area is mostly clayey, with scattered patches of vegetation. There are some rocky strips also, with small hills here and there.

RAINFALL

The rainy season usually starts from the middle of October and continues up to the middle of March. The total rainfall recorded in

Kuwait (29° 14'N 48° 00'E) during the period October 1954 to March 1955 was 7.22 inches, as given below :—

	Inches
October, 1954	0.13
November, 1954	6.00
December, 1954	0.51
January, 1955	0.32
February, 1955	0.00
March, 1955	0.26
Total	7.22

Vegetation

After the onset of rains, the whole area becomes green with grasses, which generally do not attain a height of more than two feet. *Phog* (*Calligonum polygonoides*) and *marrut* (*Panicum turgidum*) plants are generally found only in the southern region. The grasses and plants are short lived and after the close of the rainy season the whole area looks barren.

Poison Baiting

Ingredients.—The bait used was received ready-made, packed in gunny bags, from the F.A.O. authorities. Each bag contained about 90 lbs. of wheat bran, sawdust or rice husk, mixed with 2-3 lbs. of BHC (wettable powder). In all, 2,400 bags of dust were used.

Technique of spreading.—The bait was broadcast by hand, thinly and evenly, over the area infested with hoppers, by local labour, each labourer carrying the bait in a gunny bag (Fig. 1). In the case of hoppers congregating in bushes, the bait was spread round the bush to form a ring. Where the hoppers started moving, specially on roads and tracks, the poison bait was, however, spread in the form of a thick belt in front of the bands with the result that the hoppers on reaching the bait started concentrating and eating it rather than trekking off.

Dosage.—The amount of bait used per acre varied according to the density of the vegetation and of the hopper bands. On bare ground and in areas where vegetation was thin, about 30-35 lbs. of bait per acre were used, whereas in thick vegetation the dosage was 35-50 lbs. per acre and in some cases even 60 lbs. per acre.

Time of baiting.—Baiting was usually started early in the morning and continued up to 9.00 A.M. Again, in the afternoon it was carried out from 5.00 P.M. till sunset.

Results

The bait used was quick acting as some of the hoppers showed signs of acute poisoning within 1½ hours of baiting. In the month of April, when the vegetation had dried up, the hoppers preferred the bait, which was more palatable, to dry grasses. The mortality

was quite high (Fig. 2). In the case of advanced stage (IV & V instar) hoppers the mortality obtained was about 90% within 72 hours of baiting, whereas in the case of hoppers of early stages it was as much as 100%. In some instances, the hoppers remained in the baited area un-disturbed till their death.

Fig. 1

Fig. 2

CONCLUSIONS AND RECOMMENDATIONS OF THE INDO-IRANIAN ANTI-LOCUST CONFERENCE, NEW DELHI, 1955.

An Anti-Locust Conference under the revised Indo-Iranian Anti-Locust Convention signed in July, 1954, was held at New Delhi in November 1955. Delegates and observers from India, Iran and Pakistan attended the Conference, which discussed common problems of locust control. The following are the conclusions and recommendations of the Conference :

(1) Although Iran, Pakistan and India are free from locusts at present, the danger to these countries being invaded by locusts during 1956 persists. Very careful watch would have to be maintained on the locust breeding and swarm movements in Africa and Arabia during the next several months because if the climatic conditions were favourable for the locusts for winter-spring breeding in the Arabian Peninsula and if the measures organised were not equal to the magnitude of the breeding, Iran, Pakistan, Afghanistan and India may again have serious threats of locust incursions in the late spring and early summer of 1956. Therefore, all of these four countries should be fully prepared to meet the locust menace, should it materialise.

(2) The arrangement for the regular and timely exchange of information about locust swarm movements and breeding between Iran, Pakistan and India was satisfactory. However, information about the commencement of swarm incursions or migrants or breeding should be telegraphically communicated to the Plant Protection departments of the countries concerned, whenever necessary.

(3) Regular and timely information about locust swarm movements and breeding from Afghanistan was essential for assessing the locust situation in the eastern region and in order to obtain such information the Governments of Iran, Pakistan and India should approach the Government of Afghanistan through diplomatic channels and thereby ensure the supply of the information.

(4) The Conference was of the view that even during the periods when the desert locust is not active, the pest must be kept under constant and careful observation and control not in two or three countries only but throughout the entire area usually infested by it. The Conference considered that national organisations should be set up for this purpose on a permanent basis in countries where such organisations do not exist, and invited the F.A.O. to assist in this endeavour.

(5) The Conference was of the view that aeroplanes can be effectively employed to destroy locusts on large-scale under certain conditions and that they should be utilised to the maximum extent possible.

(6) The Conference was of the view that locust control organisations should be so built up as to be easily employed for plant protection purposes when locusts are not active just as locust control

itself should be helped by other Plant Protection Organisations in times of emergencies created by locust attacks. In other words, the integration of locust and other Plant Protection Organisations was most desirable.

(7) The Conference considered the question of replacing the present bilateral Anti-Locust Conventions between Iran and India and Pakistan, etc., by one Convention which may include Iran, Pakistan, Afghanistan and India. In view of the absence of any representative from Afghanistan, it agreed, however, that the existing position may continue, for the present.

DIAZINON, A NEW INSECTICIDE

By

M. V. Venkatesh,

Technical Assistant,

Directorate of Plant Protection, Quarantine and Storage, New Delhi.

Diazinon is a comparatively new introduction into the field of plant protection in India although diazinon products are known to be in use in many foreign countries for pest control. Published reports of tests conducted in India with the new pesticide are very few, if any. Diazinon is an organic ester of thio-phosphoric acid and is similar to parathion both in the mode and range of action against insects. The chief difference, however, is that diazinon is about 10 times less toxic than parathion, to man and other mammals.

Diazinon is mainly a contact insecticide and it is reported to have given better results than parathion in the treatment against certain scale insects, such as, *Eulecanium corni* and aphids, such as, *Phylloxera vastatrix*. It has proved equal to parathion in controlling certain aphids, psyllids, melolonthids as well as elaterids and mites. Some of the stem borers, which are difficult to control, such as the maize stemborer, *Chilo simplex*, and the paddy stemborer, *Schoenobius incertulas*, are reported to have been successfully and economically controlled by this insecticide.

In addition to its effectiveness and low human toxicity, it has certain other desirable properties. Its penetrancy is appreciable, it is not toxic to plant tissues, and is reported to leave no harmful residues. Further, it is stated to have exhibited certain desirable side-effects such as imparting good colour to fruits and thinness to the fruit cuticle in the case of apples.

Diazinon is formulated as a dust, emulsion or wettable powder in different concentrations. However, in India at present it is available only as 10 per cent and 40 per cent wettable powders and as 20 per cent emulsifiable solution, with M/s Geigy Insecticides Private Ltd., Bombay, under the trade name of "Basudin".

In the trials conducted by the Directorate of Plant Protection, *Quadraspidiotus perniciosus*, attacking apples in Himachal Pradesh 0.036 per cent (actual) diazinon (*i.e.*, 1 oz. of 60 per cent emulsifiable solution* in 10 gallons of water) was found to give better results than 0.03 per cent (actual) parathion (50 cc. of Folidol E605 E.C., which contains 46.6 per cent parathion, in 17 gallons of water), malathion 0.093 per cent (3 ozs. of 50 per cent malathion E.C., in 10 gallons of water), "Shell DNC Winter Wash" 7 per cent (7 lbs. in 100 lbs.), or 3–4 per cent oil emulsion.

* Specially made available by M/s. Geigy Insecticides Private Ltd., Bombay.

In preliminary trials conducted at Delhi and Hyderabad, Basudin 20 per cent emulsifiable solution* 1:1600 parts of water brought about cent per cent kill of hedge mites, while a dilution of 1:800 or 1:600 killed nymphs and pre-adults of the mango mealy bug (*Drosicha stebbingi*) and the grubs and adults of the Epilachna beetle (*Epilachna vigintioctopunctata*). Nearly 80 per cent kill of adult mealy bugs was obtained by using 20 per cent Basudin concentrate at 1:400. No phytotoxicity was observed in any case.

Basudin 20 per cent emulsifiable solution is a free-flowing, clear liquid with a faint smell of kerosene oil and is sold in ½ lb. and 10 lbs. tins costing about Rs. 5-14-0 and Rs. 94-12-0, respectively. Basudin 10 per cent wettable powder costs about Rs. 5-14-0 per lb. while 40 per cent wettable powder is priced at Rs. 20-4-0 per lb. approximately.

Although diazinon is comparatively safer than parathion, it must be remembered that it is a phosphatic insecticide and, therefore, the concentrates must be handled with due care. Inhalation of spray mist must be avoided and all other precautions should be diligently observed.

*Diazinon Tech. 20 per cent, emulsifier and stabilizer 11 per cent and solvents 69 per cent.

A CHECK LIST OF SUGARCANE DISEASES RECORDED IN INDIA*

Disease	*Cause*
Banded chlorosis .. .. (cold, or sectional chlorosis)	Physiological (low or high temperature)
Banded sclerotial (leaf) disease	*Hypochnus (Corticium) sasakii* Shirai
Black leaf spot	*Phyllachora sacchari* P. Henn.
Black rot	*Ceratostomella adiposum* (Butler) Sartoris
Brown spot	*Cercospora longipes* Butler
Brown stripe†	*Cochliobolus stenospilus* (Carp.) Matsumoto et Yamamoto *Helminthosporium stenospilum* (Drechsler)
Bunga (bulaklak)	*Aeginetia indica* L.
Cane-killing weed	*Striga* spp.
Collar rot	*Hendersonina sacchari* Butler
Downy mildew	*Sclerospora sacchari* Miy.
Dry rot	*Physalospora rhodina* (Berk. et Curt.) Cke.
Eye spot	*Helminthosporium sacchari* (v. Breda de Haan) Butler
Malgrowths	
Leafy tuft	
Tangle top (twisted top) ..	Mechanical
Mosaic	Virus
Pestalozzia leaf spot	*Pestalozzia fuscescens* sor. var. *sacchari* Wakker
Pineapple disease	*Ceratostomella paradoxa* (de Seynes) Dade
Pokkah boeng	*Gibberella fujikuroi* (Saw.) Wr. (*Fusarium moniliforme* Sheldon *Gibberella moniliforme* (Wineland)
Ratoon stunting disease .. (Q. 28 disease, stunting disease, growth retarding disease)	Undetermined
Red rot	*Physalospora tucumanensis* (Went) Speg. (*Colletotrichum falcatum* Went)
Red rot of leaf sheath ..	*Sclerotium rolfsii* Sacc.

* Extract from the Proceedings of the Ninth Congress of the International Society of Sugarcane Technologists, New Delhi, Vol. 1, 1956, pp. 1182-1196

† The occurrence of the disease is doubtful.

Red spot of leaf sheath ..	*Cercospora vaginae* Krueger
Red stripe	*Xanthomonas rubrilineans* (Lee et al) Starr et Burkh.
Rind disease	*Pleocyta sacchari* (Mass.) Petr. et Syd. (*Melanconium sacchari* Mass.)
Ring spot	*Leptosphaeria sacchari* v. Breda de Haan. (*Phyllosticta sacchari-cola* Henn.)
Root rots	*Marasmius sacchari* Wakker *Pythium* spp.
Rust ..	*Puccinia kuehnii* (Krueger) Butler
Schizophyllum rot	*Schizophyllum commune* Fr.
Sheath rot .. .. (Cytospora sheath rot, stem canker)	*Cytospora sacchari* Butler
Smut	*Ustilago scitaminea* Syd. *Sphacelotheca cruenta* Potter
Sooty mold	*Fumago* (?) *sacchari* Speg. *Capnodium* spp.
Stinking rot	*Pseudomonas desaiana* (Burkh.) Sarrel (*Bacterium pyocyaneum saccharum* (Desai)
Streak	Virus
Wilt	*Cephalosporium sacchari* Butler
Yellow spot (leaf)	*Cercospora kopkei* Krueger

SHORT NOTES

(i) Twig Blight due to *Diplodia indica* in *Mosambi* Plant in Madhya Bharat, 1954-55.

In Madhya Bharat, twig blight is observed in old *mosambi* (*Citrus sinensis*) gardens grown in the districts of Gird, Bhilsa, Indore, Dewas, Dhar and Ujjain. The twigs are found dying back to some distance from the tip ending at a "sharply defined line which separates the diseased from the healthy tissues". Sometimes, no limiting line develops until the entire twig and part of a larger branch or trunk below are involved and girdled. The attack may not begin at the tip, but at a point further down. It may then girdle the branch or twig and cause the foliage beyond, to wither and dry up. Suddenly, when branches of some size begin to die back, the disease tends to progress rapidly, with the formation of long lesions and a considerable flow of gum. A self-limiting demarcation usually takes place at the base of the smaller branches. This phenomenon is observed during the hot days of April, May and June.

The bark that has died is dotted by minute black pustules. On examination, it is observed that they are pycnidia of *Diplodia* fungus. These are observed on trees which are 10-12 years old. The disease is found to be more severe in hot season than during the rest of the year. On an average 10-20 per cent damage has been recorded in all the gardens, so far surveyed in Madhya Bharat.

The disease is minimised by cutting diseased branches and treating the cut portion with Bordeaux paste. Good cultivation and sanitation also help to reduce the disease.

Agricultural Research Institute, Gwalior.

B. G. Nikam.
F. K. Pawar.

(ii) Blast Disease of Paddy

Excessive application of nitrogenous manures makes the non-resistant varieties of paddy plants, susceptible to this disease. Blast disease of paddy is the most important disease causing serious damage to the rice crop in Madras State. This is caused by a fungus,

Piricularia oryzae.

The disease manifests itself in the nursery stage which can be identified by the presence of spindle-shaped, greyish brown spots on the leaves. These present a blasted appearance to the whole nursery when found in large numbers. The disease can also be observed in the planted crops. The serious stage of the disease is the neck infection of the crop, when the neck region just below the earhead, turns dark in colour. This is the most destructive phase of the disease as this obstructs the flow of sap to the earhead as a consequence of which there will not be proper setting of grains and the ears will be chaffy. Further, this results in the snapping of the earhead at the infected neck region, whenever there is slight disturbance of the ear and thereby causes reduction in yield. The disease

attacks the nodes of culm also, in which case the straw breaks at these nodes. In the early stages, spread of the disease can be controlled by spraying the nursery with one per cent Bordeaux mixture or any other approved copper fungicide. The planted crop also may be sprayed with the fungicide.

However, the best method of avoiding the disease is growing of resistant varieties of paddy, namely, Co. 25, Co. 26, Adt. 25 and T.K.M. 1. The variety of T.K.M. 1 is a short duration variety while others are long duration varieties. Excessive application of nitrogenous manures renders the plants more susceptible to the disease in the case of susceptible and moderately susceptible varieties, whereas the resistant varieties are able to stand much higher doses of nitrogenous fertilizers, without their resistance being impaired.

(*Extract from the Madras Agricultural News Letter, July,* 1956)

(iii) New Chlorotic Disease of Sugarcane

A new chlorotic disease of sugarcane, which causes a yield loss of 22 per cent in a 100 per cent affected field, has been recorded at the farm of the Indian Institute of Sugarcane Research.

(1) *Grassy shoots in clusters.*—The shoots assume grassy growth. Growth of clumps is stunted and leaves are narrow, chlorotic and yellowish-white in colour.

(2) *Thin stalks with sprouted side-shoots.*—Stalks are thin and leaves of spindle are chlorotic with yellowish-white colour. Premature sprouting of side-shoots takes place. The leaves of these side-shoots are also yellowish-white in colour, narrow and tapering sharply at the tip.

(3) *In apparently healthy canes.*—The stalks look quite normal but there is premature sprouting of side-shoots with yellowish-white leaves, as in (2).

The main points of difference between the new chlorotic disease and other types of chlorosis are as follows :—

(*i*) Ordinary chlorosis ..	Leaves of spindle yellowish-white, no grassy growth and sprouting of side-shoots.
(*ii*) *Sectional* or *cold* chlorosis ..	Colourless bands on leaf blade, canes healthy and normal.
(*iii*) *Lime* chlorosis ..	Absence of grassy growth, shoots of plant cane or ratoon uniformly yellow, and no premature sprouting of side-shoots.
(*iv*) *Striped* chlorosis ..	Light yellowish or pallid stripes along the entire length of leaves. Normal canes.

(*Indian Institute of Sugarcane Research, Lucknow, Newsletter Vol. II, No.* 8, *August,* 1956)

NEWS AND NOTES

I. Indian Standards for Pesticides

With the implementation of large scale developmental programmes in the fields of agricultural production and public health under the First and Second Five Year Plans, the use of pest control products registered a marked increase all over the country. Various pest control products are either manufactured in the country or formulated locally, using imported ingredients. However, the knowledge of the nature and properties of the constituent materials used in the manufacture or formulation is confined to scientific and technical personnel employed in certain Government departments and private concerns dealing with such products. Until recently, the cultivators, plant protection workers and others, who were the ultimate users of these products, had no guarantee of the purity and efficacy of the pesticides that were supplied to them. Further, under the varying climatic conditions obtaining in different parts of the country, pesticide formulations may deteriorate in storage, if the materials used in them are not of approved standard. Therefore, realising the need for laying down standards for pest control products, the Indian Standards Institution set up a Pest Control Products Sectional Committee under its Chemical Division Council, in March, 1953. The Committee's task was to prepare standards for a number of pest control products, like insecticides, fungicides and fumigants, used in India and, at the international level, to coordinate its work with that of the proposed Technical Committee on Pest Control Products of the International Standards Organisation. Soon after its establishment, the Sectional Committee embarked on the preparation of draft standards for technical grades of BHC and DDT and for dusting and water dispersible powders containing these insecticides as well as for a fumigant mixture containing Ethylene Dichloride and Carbon Tetrachloride. The draft standards for BHC and DDT insecticides were circulated for comments and then finalised early in 1955, when the Sectional Committee further decided to take up the following other items for the preparation of standards :

(*a*) BHC and DDT emulsion concentrates with various percentages of active ingredients;
(*b*) BHC smoke generators;
(c) Different types of formulations of
  (*i*) Aldrin,
  (*ii*) dieldrin,
  (*iii*) pyrethrin extracts;
(*d*) Nicotine Sulphate;
(*e*) Copper Oxychloride.

In January 1955, the Sectional Committee prepared a tentative list of common names for pest control chemicals, which could be used in India till the publication of an approved list of internationally recognised common names for pest control chemicals, by the

Technical Committee of the International Standards Organisation. The first series of six Indian standards on BHC and DDT technical grades and formulations was published in 1955.

A separate Agricultural and Food Products Division was established in the Indian Standards Institution and inaugurated by Shri Ajit Prasad Jain, Union Minister for Food & Agriculture, on 18th February, 1956. A Sectional Committee under it was set up to continue the work of preparing standards for pest control products. Draft standards were prepared for pyrethrum extracts, lime sulphur solution and nicotine sulphate solution, dieldrin technical grade, water dispersible powder and emulsifiable concentrate as well as for the common names of the more commonly used pest control chemicals. Four more standards for BHC and DDT were finalised and approved in 1956.

The Directorate of Plant Protection, Quarantine and Storage, was associated with the Indian Standards Institution in the formulation of the above standards. The Plant Protection Adviser to the Government of India was nominated a member of the Agricultural and Food Products Division Council. The Plant Protection Adviser and the Deputy Director (Plant Diseases) served as members of some of the different Sub-committees which drew up the draft standards.

II. F.A.O. Panel of Experts on Locusts

As recommended by the Fifth Session of the FAO Technical Advisory Committee on Desert Locust Control, held in Damascus from 4th to 6th August 1955, the Director-General of FAO established a Panel of Experts to prepare a comprehensive plan of investigations required, before attempting to formulate or implement any long term policy of Desert Locust Control. The Panel consisted of C.I.H. Aspliden, Switzerland, A. Davatchi, Iran, M. Afzal Hussain, Pakistan, Mohamed Hussein, Egypt, R. J. V. Joyce, Sudan, E. Morales Agacino, Spain, Y. Ramachandra Rao, India, C. Rungs, Morocco, B. P. Uvarov (Chairman), England, and O. B. Lean of the FAO Staff. The following were the terms of reference of the Panel :—

(*a*) To review present knowledge of the factors affecting Desert Locust outbreaks and the build-up and recession of plagues;

(*b*) To prescribe those factors requiring particular investigations;

(*c*) To recommend the technical requirements for the study of these factors;

(*d*) To plan organisational requirements needed to undertake these investigations;

(*e*) To propose arrangements for centralizing, analyzing and disseminating the acquired results of such investigations.

The Panel of Experts met in London from 9th to 20th April, 1956, and submitted its report a little later.

III. F.A.O. Locust Meetings

(1) The Sixth Session of the FAO Technical Advisory Committee on Desert Locust Control was held in Tehran from 3rd to 6th July 1956, with the main purpose of discussing the report of the FAO Panel of Experts on Locusts and recommending to the Acting Director-General the steps to be taken by FAO to implement the Panel's findings. Owing to the importance of the subject under discussion, at the invitation of the Acting Director-General of FAO, observers from the Arab League, World Meteorological Organisation, Ethiopia, Iraq and Sudan as well as some members of the FAO Staff attended the meeting, besides the delegates from the seven member countries, *viz.*, Egypt, France, India, Iran, Pakistan, the United Kingdom and the United States of America. The Committee recommended that :

(*i*) The Director-General of FAO should accept the report of the Panel of Experts with due consideration to the various comments and recommendations of the FAO Technical Advisory Committee.

(*ii*) FAO should call the attention of Governments to the types of supervision and survey of Desert Locust populations considered to be necessary in the various territories.

(*iii*) FAO should assemble information on existing national services for supervision, survey and reporting, with a view to developing a co-ordinated and standardized information service.

(*iv*) The Director-General should approach the United Kingdom Government to determine whether the Anti-Locust Research Centre, London, could serve as co-ordinator of information on the occurrence and activity of the Desert Locust and the weather affecting it.

(*v*) The Director-General should call the attention of governments to the need for continuance of organized vigilance and adequate control during recession and regression periods.

(*vi*) FAO should, with the assistance of the United States Regional Insect Control Project, make a census of suitable aircraft which could be made available for Desert Locust Control work and prepare a plan for the utilization of such aircraft in cases of emergency.

(*vii*) Rather than establishing any form of international field research station, FAO should proceed through co-operative arrangements with existing stations on a project basis.

(*viii*) FAO should provide, on a project basis, assistance to supplement national research efforts.

(*ix*) Before planning any special international survey missions to study topographical, climatic and vegetational features of little-known areas, FAO should approach the governments concerned to determine whether they could undertake these surveys and whether any assistance would be required.

(x) FAO should establish a special mission or missions to undertake a general ecological survey of the main breeding areas of the Desert Locust, in co-operation with existing national or other organisations engaged in this type of work.

(xi) FAO should circulate periodically schedules of assisted projects and brief progress reports on research projects assisted by the Organisation for review and information.

(2) The Third Session of the FAO Desert Locust Control Committee was held in Tehran from 8th to 12th July 1956, and attended by delegates from Egypt, Ethiopia, France, India, Iran, Iraq, Jordan, Lebanon, Libya, Pakistan, Saudi Arabia, Syria, Turkey, the United Kingdom and the United States of America. Representatives from Morocco and Sudan and observers from Arab League and the Union of Soviet Socialist Republics as well as some members of the FAO Staff also attended the Session. The Session unanimously elected Mr. Mostafa Zahedi from Iran, which was the host country, as the Chairman, and Mr. Akram Ricaby and Dr. K. B. Lal, from Syria and India respectively, as the Vice-Chairmen. The Committee received from the delegates accounts of the national anti-locust organisations and operations undertaken within their countries since the previous session of the Committee in August 1955. It emphasized the importance of collecting information on national expenditure on Desert Locust Control and reviewed the results of the International Anti-Locust Campaign in the Arabian Peninsula during 1955-56. The total expenditure incurred on this campaign was estimated at US $ 13,94,124. The Committee generally agreed with the findings and recommendations of the FAO Panel of Experts on Long Term Policy of Desert Locust Control but felt that FAO should give first priority to supporting international control campaigns in the Arabian Peninsula and utilise the balance of funds available for implementing certain of the Panel's recommendations. Among other things, operational plans for the 1956/57 International Anti-Locust Campaign in the Arabian Peninsula, were discussed.

IV. F.A.O. Plant Protection Committee for the South East Asia and Pacific Region

A Plant Protection Agreement for the South East Asia and Pacific Region was drafted by representatives of Australia, Ceylon, United Kingdom, Laos, Netherlands, Indonesia, Portugal, Vietnam, India and Thailand, at a meeting held in Singapore from 13 to 17 December, 1954. India was represented at the Meeting by Dr. K. B. Lal, Plant Protection Adviser to the Government of India. The Agreement was signed by India on 2nd July, 1956, on which date it became effective. The Agreement aims at preventing the introduction and movement of destructive plant diseases and pests in the Region and provides for the establishment of a regional committee as an advisory body to participating governments, on procedures and arrangements required for its implementation.

Accordingly, the Director-General of FAO convened the First Meeting of the Plant Protection Committee for the South East Asia and Pacific Region in Bangkok from 3 to 7 December, 1956, at the

invitation of the Government of Thailand. Delegates and observers from the above mentioned countries except India, and some members of the FAO staff attended the meeting. His Excellency Field Marshal Phin Chunhavan, who inaugurated the Meeting, stressed the importance of international co-operation in preventing the introduction of destructive plant diseases and pests from outside the Region, especially in view of the speed and range of modern transportation, and expressed the belief that the Plant Protection Agreement would be of great benefit to all the countries and territories concerned.

Representatives from participating countries gave brief accounts of the existing plant quarantine activities in their respective countries. Dr. K. B. Lal sent a statement on the organization of plant quarantine service in India, which was circulated at the Meeting. He assured all the participants that he would assist and co-operate with them in making the Plant Protection Agreement as effective and successful as possible.

The Committee recommended measures for regulating the importation and movement of plants designed to prevent the introduction and spread of dangerous pests and diseases affecting crops of economic importance to the Region, such as cacao, sugarcane, coffee, sweet potato, potato, citrus, banana and cotton. The Committee desired to check or prevent the spread of certain diseases such as the potato-wart disease, virus diseases of *Theobroma*, bunchy top of banana, etc.

The Committee recommended, among other things, that :

(*i*) Signatory governments whose signatures are subject to ratification expedite ratification without delay.

(*ii*) Participating governments make full use of the training facilities offered by FAO, Colombo Plan, etc., through the granting of fellowships and the provision of experts to serve as instructors in the national training programmes.

(*iii*) Every territory in the Region introduce legislation to control the movement of plants by air.

(*iv*) Every participating government prepare a list of pests and diseases known to occur in its territory.

(*v*) FAO distribute to all participating governments reference specimens of certain pests and diseases, preserved in such a manner that it would not involve risk of introducing viable material in that Region.

(*vi*) A list of weeds be submitted by the representative of each participating government attending the next Meeting of the Committee.

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